

Translation of pertinent portions of PCT/IPEA/409 dated June 13, 2006 for
PCT/EP2004/053275:

2. This report includes a total of 6 pages, including this cover page.
3. There are also ENCLOSURES, which include
 - [X] (sent to Applicant and the International Office) at total of 12 pages, which are
 - [X] pages of the specification, claims and/or drawings that have been amended and on which this report is based, and/or pages with corrections made before this office (see Rule 70.16 and section 607 of the PCT administrative guidelines).
4. This report contains indications relating to the following items:
 - I [X] Basis of the report
 - V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step add industrial applicability, citations and explanations supporting such statement

I. Basis of the report

1. With regard to the language, this report is based on

[X] the international application in the language in which it was filed.

2. With regard to the parts (one or all of these pages may be marked "replaced") of the international application, this report is based on the following:

Specification, pages

5-9, as originally filed

1, 1a, 1b, 2-4, received on November 23, 2005, with the letter dated November 3, 2005

Claims, Nos.

1-22, received on November 23, 2005, with the letter dated November 3, 2005

Drawing, page 1/1, as originally filed

V. Reasoned statement...

1. Statement

Novelty (N) Yes: Claims 1-22
Inventive Step (IS) Yes: Claims 1-22

Industrial Applicability (IA) Yes: Claims 1-22

2. Citations and explanations (Rule 70.7)

see appended page

V. Reasoned Statement ...

1. With its letter of November 3, 2005, Applicant has made arguments against the reservations raised in the Office Action of August 2, 2005 as to novelty and inventive step.

New claims 1-22 were submitted.

2. Claims 1-14

Reference D1 is considered the closest prior art to the subject of claim 1. It discloses (terms in parentheses pertain to this reference) a connection system for connecting at least one contact of at least one flat block of components (20a) to at least one apparatus (100), having a conductive connecting element (56), connected electrically conductively to the at least one contact of the flat block of components (20a), and a clamping device (34) connected electrically conductively to the apparatus,

and the clamping device (54) is embodied to receive the connecting element (56) and thus via the connecting element (56) to produce an electrically conductive connection between the apparatus (100) and the contact of the flat block of components (20a), and the connecting element (56) connected to the at least one contact of the flat block of components (20a) is embodied as a rigid conductor.

The subject of claim 1 is therefore distinguished from the known connection system in that the connecting element connected to the at least one contact of the flat block of components is embodied in the form of a screw electrically conductively secured to the contact of the flat block of components, which screw, with a shaft that has a thread, penetrates a bore, made in the flat block of components in the region of the contact, and which screw is locked via a nut on a second side of the flat block of components that is diametrically opposite a first side of the flat block of components.

The subject of claim 1 is thus novel (Article 33(2) PCT).

The object to be attained by the present invention can thus be considered to be creating a connection system with a simple, sturdy construction.

The embodiment proposed in claim 1 of the present application for attaining this object is

based for the following reasons on an inventive step (Article 33(3) PCT): no suggestion in the prior art for this embodiment.

Claims 2-14 are dependent on claim 1 and thus likewise meet the requirements of PCT for novelty and inventive step.

3. Claims 15-22

Reference D1 is considered the closest prior art to the subject of claim 15. It discloses (terms in parentheses pertain to this reference) a flat block of components (20a) having at least one contact for connection to at least one apparatus (100), which has an electrically conductively connected clamping device (34), and the flat block of components (20a) has a conductive connecting element (56), connected electrically conductively to the at least one contact, and the connecting element (56) is embodied as a rigid conductor.

The subject of claim 15 is therefore distinguished from the known connection system in that the connecting element is embodied in the form of a screw electrically conductively secured to the contact of the flat block of components, which screw, with a shaft that has a thread, penetrates a bore, made in the flat block of components in the region of the contact, and which screw is locked via a nut on a second side of the flat block of components that is diametrically opposite a first side of the flat block of components.

The subject of claim 15 is thus novel (Article 33(2) PCT).

The object to be attained by the present invention can thus be considered to be creating a flat block of components for a connection system with a simple, sturdy construction.

The embodiment proposed in claim 1 of the present application for attaining this object is based for the following reasons on an inventive step (Article 33(3) PCT): no suggestion in the prior art for this embodiment.

Claims 16-22 are dependent on claim 1 and thus likewise meet the requirements of PCT for novelty and inventive step.

Specification

CONNECTION SYSTEM FOR CONNECTING AT LEAST ONE CONTACT OF AT LEAST ONE FLAT BLOCK OF COMPONENTS TO AT LEAST ONE APPARATUS

The present invention relates to a connection system for connecting at least one contact of at least one flat block of components to at least one apparatus having the characteristics of the preamble to independent claim 1 and to a flat block of components having the characteristics of the preamble to independent claim 8 as well as to an apparatus having the characteristics of the preamble to independent claim 14.

Thus the present invention relates to a connection system for connecting at least one contact of at least one flat block of components to at least one apparatus, which system has a conductive connecting element, connected electrically conductively to the at least one contact of the flat block of components, and a clamping device connected electrically conductively to the apparatus, and the clamping device is embodied to receive the connecting element and thus, via the connecting element, to make an electrically conductive connection between the apparatus and the contact of the flat block of components. The invention thus furthermore pertains to a corresponding flat block of components and a corresponding contact.

A connection system of this kind is typically realized by means of a cable harness, so that typically the conductive connecting element comprises individual conductors of the cable harness that are insulated from one another.

When cable harnesses are used, it is disadvantageous that many individual conductors have to be connected. As a result, there is a great risk that individual conductors will be transposed, and as a result incorrect electrical connections are made and short circuits can be caused.

From US Patent 6,036,508 A, an electrical connection device is known, having a first end that is disposed with some motion play on a flat block of components, and a second end, which has a bush for receiving a bolt of a conductor busbar. This electrical connection device is intended as an adapter between the conductor busbar on the one hand and the flat block of components on the other, so that by the play of motion of this adapter relative to the flat block of components to compensate for a production variation or a thermal misfit.

From International Patent Disclosure WO 02/089260 A, a connection device is known by which electrical power can be transferred from a first flat block of components to a second flat block of components; this connection device includes a first line element in which a second line element is disposed. The first and second line elements, in one embodiment, are embodied in the form of cylinders located coaxially to one another, which with their respective ends are each in electrical contact with a respective one of the first and second flat blocks of components; the first and second flat blocks of components are held together, with the disposition of the first and second cylinders between them, by a screw located coaxially to them.

From US Patent 5,411,418 A, a combination of a flat block of components that has many holes, a connection device that borders on the flat block of components and has an insulator with leadthroughs that are aligned with the holes of the flat block of components, and many contacting means that are each connected by a solder-free press fit to a respective one of the holes in the flat block of components and are each disposed with another portion in a respective one of the leadthroughs of the insulator.

From US Patent 4,812,130 A, a flat block of components with a conductive connection part is known; the connection part includes a shoulder part which contacts a surface of the flat block of components and a lower part that is widened such that it contacts a conductive coating, which adjoins an opening in the flat block of components on the diametrically opposed surface of the flat block of components. As a result, the flat block of components is as it were clamped in place between the shoulder part and the lower part of the connection part. In one embodiment, the connection part has a prong which can be inserted into a plug in order to make an electrical connection.

From US Patent 6,066,006 A, an apparatus with a flat block of components is known on which a conductor busbar is secured by means of many electrically conductive fastening means. The fastening means are embodied in particular in the form of prongs disposed on the flat block of components that each have a thread to which the conductor busbar is screwed to nuts in order to make an electrical as well as a mechanical connection with the prongs; as a result of the screwing operation, the conductor busbar is as it were mechanically clamped between the flat block of components on the one hand and the nut on the other.

It is therefore the object of the present invention to make a connection system for connecting at least one contact of at least one flat block of components to at least one apparatus available in which the transposition of connecting elements can be reliably avoided, and the connection system generally has an especially simple, sturdy construction. It is a further object of the present invention to make a corresponding flat block of components and a corresponding apparatus available.

In a connection system having the characteristics of the preamble to claim 1, this object is attained by the characteristics of the body of independent claim 1. In the case of a flat block of components having the characteristics of the preamble to independent claim 15, this object is attained by the characteristics of the body of independent claim 15.

Because the connecting element is embodied as a rigid conductor connected to the flat block of components, confusing the conductor with another conductor and thus making incorrect wiring is precluded. Moreover, plugs and fastening material for the flat block of components can be dispensed with, since the flat block of components can be retained by the clamping device directly via the rigid conductor of the connecting element. Because the connecting element engages the clamping device of the apparatus directly, a compact construction of the connection system is furthermore attained.

The rigid conductor forming the connecting element is a screw fastened electrically conductively directly to the contact of the flat block of components. The screw, with a shaft having a thread, penetrates a bore made in the flat block of components in the region of the contact, and the screw is locked via a nut on a second side of the flat block of components diametrically opposite a first side of the flat block of components.

Such a construction has especially great stability.

In the particularly preferred embodiment, it is also advantageous if the head of the screw comes into electrical contact with the contact on the first side of the flat block of components, and/or the nut of the screw comes into electrical contact with the contact on the second side of the flat block of components, because in this way an electrical connection between the contact and the connecting element can be established especially easily.

For further improvement of the electrical contact or for easier installation of the screw and nut, it can furthermore be advantageous if the head and/or the nut of the screw is soldered or welded to the contact.

In a further embodiment of the present invention, it is advantageous if the flat block of components is an assembled printed circuit board.

In this case, preferably one or more rectifiers for one or more inverters of a magnetic resonance gradient amplifier are disposed on the printed circuit board and are connected to one or more associated apparatuses via one or more connecting elements and one or more clamping devices.

In general, it is advantageous if the at least one clamping device of the at least one apparatus

is furnished directly on the at least one apparatus or via one or more separate ...

Claims

1. A connection system for connecting at least one contact (1a, 1b, 1c, 1d, 1e, 1f, 1g) of at least one flat block of components (2) to at least one apparatus (3a, 3b, 3c),
having
a conductive connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g), connected electrically conductively to the at least one contact (1a, 1b, 1c, 1d, 1e, 1f, 1g) of the flat block of components (2), and
a clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h), connected electrically conductively to the apparatus,
in which the clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) is embodied for receiving the connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) and thus via the connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) making an electrically conductive connection between the apparatus (3a, 3b, 3c) and the contact (1a, 1b, 1c, 1d, 1e, 1f, 1g) of the flat block of components (2),
characterized in that the connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) connected to the at least one contact (1a, 1b, 1c, 1d, 1e, 1f, 1g) of the flat block of components (2) is embodied as a rigid conductor in the form of a screw fastened electrically conductively to the contact (1a, 1b, 1c, 1e, 1f) of the flat block of components (2), which screw, with a shaft (8a, 8b, 8c, 8e, 8f), penetrates a bore (9a, 9b, 9c, 9e, 9f) made in the flat block of components (2) in the region of the contact (1a, 1b, 1c, 1e, 1f), and which is locked, on a second side (11) of the flat block of components diametrically opposite a first side (10) of the flat block of components (2), via a nut (7a, 7b, 7c, 7e, 7f).
2. The connection system as defined by claim 1,
characterized in that the connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) directly engages the clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) of the apparatus (3a, 3b, 3c).
3. The connection system as defined by one of the foregoing claims,
characterized in that the flat block of components (2) is an assembled printed circuit board.
4. The connection system as defined by claim 3,
characterized in that one or more rectifiers for one or more inverters of a magnetic resonance gradient amplifier are disposed on the printed circuit board (2) and are connected to one or more associated apparatuses (3a, 3b, 3c) via one or more connecting elements (4a, 4b, 4c, 4d, 4e, 4f, 4g) and one or more clamping devices (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h).

5. The connection system as defined by one of the foregoing claims, characterized in that the connection system is embodied for connecting many contacts (1a, 1b, 1c, 1d, 1e, 1f, 1g) of the at least one flat block of components (2) to many clamping devices (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) of the at least one apparatus (3a, 3b, 3c), and the connecting elements (4a, 4b, 4c, 4d, 4e, 4f, 4g) are disposed on the at least one flat block of components (2) in accordance with the disposition of the clamping devices (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h).

6. The connection system as defined by one of the foregoing claims, characterized in that the at least one clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) is a screw terminal (5a, 5b, 5c, 5g) or a spring clip (5e, 5f, 5g, 5h).

7. The connection system as defined by one of the foregoing claims, characterized in that it is suited for conducting voltages of over 24 volts, preferably over 120 volts, and especially preferably over 240 volts and/or currents of over 0.5 ampere, preferably over 1 ampere, and especially preferably over 10 amperes.

8. The connection system as defined by one of the foregoing claims, characterized in that the at least one clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) of the at least one apparatus is furnished directly on the at least one apparatus (3a, 3b, 3c) or via one or more separate securing robots electrically connected to the apparatus.

9. The connection system as defined by claim 8, characterized in that a plurality of securing robots are disposed in a row on a distributor busbar.

10. The connection system as defined by one of claims 14 through 16, characterized in that the device (3a, 3b, 3c) is embodied as a transformer for furnishing a potential-free supply voltage for full bridge inverters of a magnetic resonance gradient amplifier.

11. The connection system as defined by one of the foregoing claims, characterized in that the screw (4a, 4b, 4c, 4e) has a head (6a, 6b, 6c, 6e), which comes into electrical contact with the contact (1a, 1b, 1c, 1e) on the first side (10) of the flat block of components (2).

12. The connection system (2) as defined by one of the foregoing claims,

characterized in that the nut (7a, 7b, 7c, 7f) comes into electrical contact with the contact (1a, 1b, 1c, 1f) on the second side (11) of the flat block of components (2).

13. The connection system (2) as defined by one of claims 11 or 12, characterized in that the head (6a, 6b) of the screw (4a, 4b, 4c) is soldered or welded to the contact (1a, 1b, 1c).

14. The connection system (2) as defined by claim 11 or 12, characterized in that the nut (7a, 7c) is soldered or welded to the contact (1a, 1b, 1c).

15. A flat block of components (2) having at least one contact (1a, 1b, 1c, 1d, 1e, 1f, 1g) for connection to at least one apparatus (3a, 3b, 3c), which has an electrically conductively connected clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h),

in which the flat block of components (2) has

a conductive connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) connected electrically conductively to the at least one contact (1a, 1b, 1c, 1d, 1e, 1f, 1g),

characterized in that connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) is embodied as a rigid conductor in the form of a screw fastened electrically conductively to the contact (1a, 1b, 1c, 1e, 1f) of the flat block of components (2), which screw, with a shaft (8a, 8b, 8c, 8e, 8f), penetrates a bore (9a, 9b, 9c, 9e, 9f) made in the flat block of components (2) in the region of the contact (1a, 1b, 1c, 1e, 1f), and which is locked, on a second side (11) of the flat block of components diametrically opposite a first side (10) of the flat block of components (2), via a nut (7a, 7b, 7c, 7e, 7f).

16. The flat block of components (2) as defined by claim 15, characterized in that the connecting element (4a, 4b, 4c, 4d, 4e, 4f, 4g) is embodied for direct engagement in the clamping device (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h) of the apparatus (3a, 3b, 3c).

17. The flat block of components as defined by claim 15 or 16,

characterized in that the flat block of components (2) is an assembled printed circuit board.

18. The flat block of components as defined by claim 17,

characterized in that one or more rectifiers for one or more inverters of a magnetic resonance gradient amplifier are disposed on the printed circuit board (2) and are connected to one or more associated apparatuses (3a, 3b, 3c) via one or more connecting elements (4a, 4b, 4c, 4d, 4e, 4f, 4g) and one or more clamping devices (5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h).

19. The flat block of components (2) as defined by one of claims 15 through 18, characterized in that the screw (4a, 4b, 4c, 4e) has a head (6a, 6b, 6c, 6e), which comes into electrical contact with the contact (1a, 1b, 1c, 1e) on the first side (10) of the flat block of components (2).

20. The flat block of components (2) as defined by one of claims 15 through 19, characterized in that the nut (7a, 7b, 7c, 7f) comes into electrical contact with the contact (1a, 1b, 1c, 1f) on the second side (11) of the flat block of components (2).

21. The flat block of components (2) as defined by one of claims 19 or 20, characterized in that the head (6a, 6b) of the screw (4a, 4b, 4c) is soldered or welded to the contact (1a, 1b, 1c).

22. The flat block of components (2) as defined by claim 20 or 21, characterized in that the nut (7a, 7c) is soldered or welded to the contact (1a, 1b, 1c).